Ohio Agricultural Experiment Station

CIRCULAR No. 137

WOOSTER, OHIO, JUNE 9, 1913

GRASSHOPPERS*

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Grasshoppers sometimes become very abundant over limited areas in Ohio, and while the attacks never reach the proportions of those in the central and western states, nevertheless outbreaks frequently occur which demand the execution of prompt control measures.

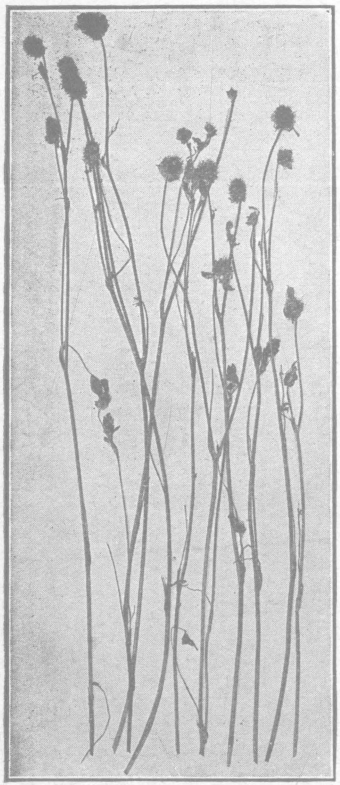
The last season witnessed several such outbreaks within the borders of the state; the principal ones being at Upper Sandusky, Berea and Athens. At Upper Sandusky, the Station assisted in the testing of methods of control, and it is the main purpose of this circular to explain those which were found successful.

THE SCOURGE AT UPPER SANDUSKY

On June 28th, the writer was called to Upper Sandusky by a letter from Master Horace Wood, a schoolboy who had been taught by his teacher to use the Experiment Station in solving difficult farm problems. Upon my arrival, I found that the insects had developed in such great numbers a short time previous, that the leaves of the clover had been eaten, and that the crop of 14 acres had been cut prematurely in order to prevent losing all of it (See Fig. 1). At the time of my arrival, the hay had just been made and cared for, and the hungry hoppers, being deprived of the greater part of their food supply, had turned their attention to the oats, rye and corn crops of the bordering fields, and were slowly migrating out of the stubble, seemingly preferring, for the most part, to crawl rather than fly.

Countless numbers still remained in the clover stubble, however, and were subsisting upon whatever vegetation was remaining; the common broad-leaved plantain being the favorite food plant. In walking through the stubble, a host of the insects arose in short flight, forming a continuous swarm of at least two or three hundred individuals about one.

*Mainly *Melanoplus bivittatus* (*Say.*) and *M. femur-rubrum* (De Geer).



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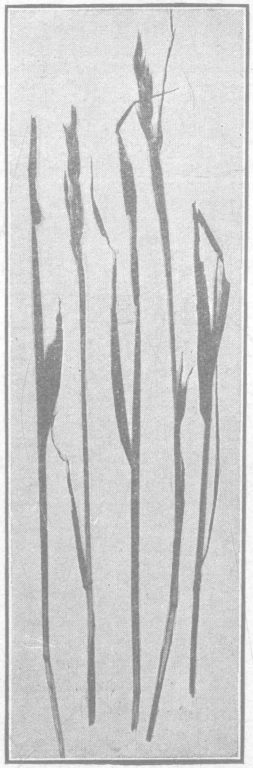

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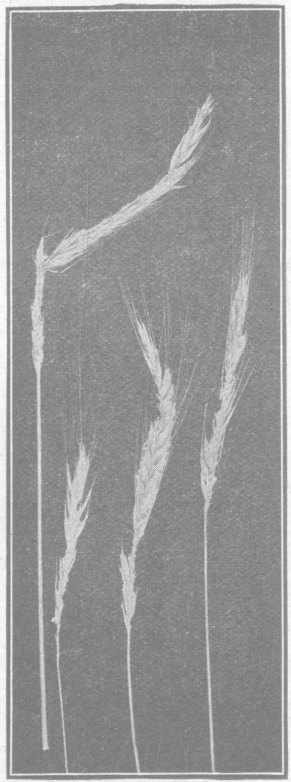

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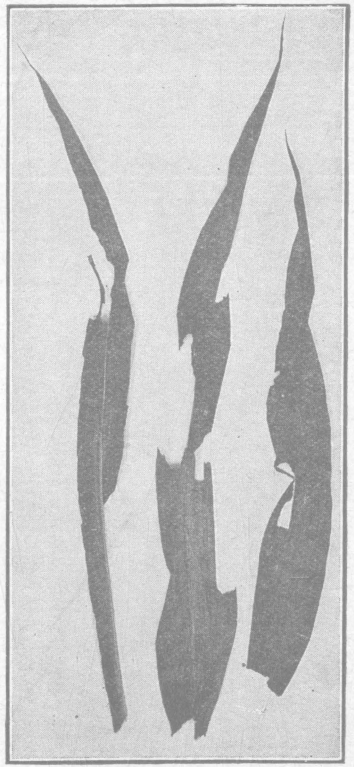

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Figures 1, 2, 3 and 4, grasshopper injury to clover, oats, rye and corn respectively.

Chickens and turkeys were growing fat feeding on the hoppers and, while the number about was greater than on the average farm, their feeding seemed to make little impression towards decreasing the numbers of the insects.

The oats, rye and corn were growing in adjoining fields, and were all attacked to a considerable extent, as indicated by the accompanying illustrations, Figs. 2, 3, and 4. The rye was practically ripe and as the oats crop was still green, the principal migration seemed to be towards that field. In fact, as one walked through the grass-stubble, and the insects rose in flight about him, there was a marked tendency for them to fly towards the oat field. In the rye, the insects were feeding on the heads, fully one-third of which bore feeding hoppers. Many of the heads were almost half eaten away and it was difficult to find any which had escaped injury.

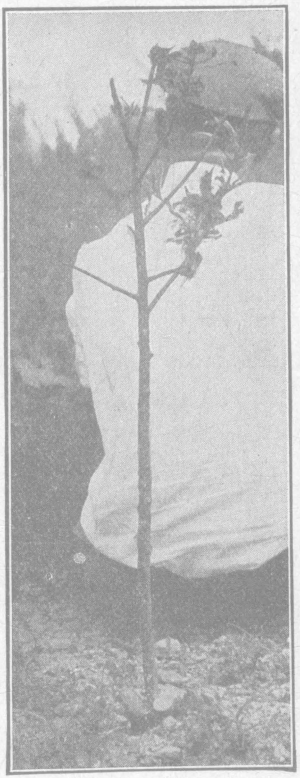

Fig. 5. Young apple almost defoliated by grasshoppers.

In the oats, the insects were feeding mainly upon the green leaves, but the heads and grain also were affected. A particularly pernicious phase of the injury was the cutting off of the stem supporting the spikelets of grain, thus causing the latter to fall to the ground, a complete loss.

The injury to both rye and oats was, as one would expect, more severe on the side of the field bordering the hay stubble, but the hoppers were rapidly migrating to all parts of the other fields.

The corn was small and was not so severely attacked; the leaves shown in the illustration being from a patch of sweet corn, bordering the meadow. However, while not so severe as inflicted on other grains, the injury to this crop could by no means be overlooked.

On account of lack of time, a survey to determine the extent of the area attacked by the hoppers could not be made, but about ten days later a long drive was taken through it, and, by observation and inquiry, the conclusion was reached that it extended over about 25 square miles. This entire section, however, was not uniformly

affected throughout. Some of the crops, especially grass, were greatly injured, and in many cases where oats bordered cut grass fields, the crop was practically stripped of its leaves. It was also learned at this time that hoppers had abounded in some parts of the region during the previous season, but it is believed that the harm was not so widespread in extent.

BEREA AND ATHENS OUTBREAKS

At both Berea and Athens, hoppers were abundant during the early summer, though the extent of injury was not nearly so severe, nor so widespread, as it was at Upper Sandusky. At Berea, some damage was done truck-crops, the insects seeming to feed with almost equal avidity on cabbage, beets, turnips and a number of other garden plants. At Athens, the principal harm was done to pastures and young orchards. The accompanying illustration, (Fig. 5) shows a young apple tree practically defoliated. Some of the trees in the orchard in which this picture was taken not only had been stripped of their leaves, but, in addition, some of the bark was eaten from the twigs.

THE HOPPER DOZER

The hopper dozer, as the hopper-catching machine is commonly called, has, for years, been relied upon in the western states for controlling scourges of these insects; but whether it would be effective under Ohio conditions remained to be demonstrated. The conditions at Upper Sandusky were so favorable for the trial of this implement that it was decided to test its efficiency. Accordingly one was hastily constructed from rough lumber and other makeshift material and, while crude in appearance and get-up, the results obtained certainly justified the time and expense involved in its construction. The following photographs and drawings illustrate the construction and operation of the machine. Briefly, it is a trough mounted on runners. It is provided with a backstop at the back side and a slanting platform at the front. In the trough is about 3 inches of water on top of which floats a half inch of kerosene. As the implement is pulled over the field by a horse hitched at each end, the hoppers are frightened by its

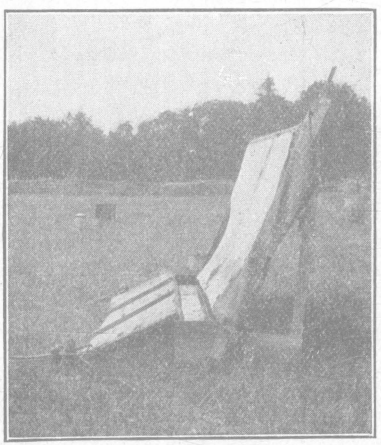

Fig. 6. The hopper dozer, end view.

approach. This causes them to spring or fly into the air, where they collide with the backstop of the machine, which meantime has been pulled beneath them. Since the backstop is covered with smooth material, the insects cannot obtain a foothold and therefore slide into the trough of oily liquid where they are killed.

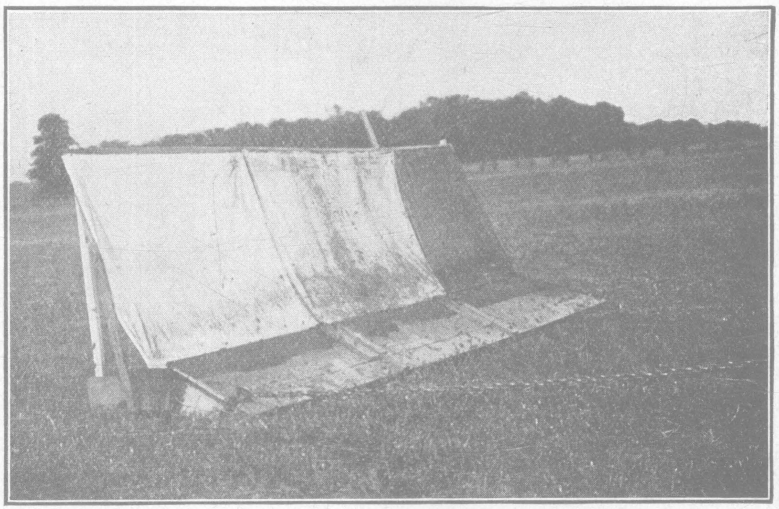

Fig. 7. The hopper dozer, side view, taken while machine was in motion. The black spots are hoppers falling into the trough.

Fig. 6 shows an end view of the dozer, and Fig. 7 a side view. The photograph shown in Fig. 7 was taken while the dozer was in motion and the black spots are the hoppers actually tumbling into the trough. Detailed drawings of the machine are shown in Figs. 8 and 9, in which the end and side views are shown. In both illustrations, A is the incline or approach, 20 inches wide by 16 feet long, made of rough inch lumber. B is the trough, 8 inches wide, 8 inches deep, and 16 feet long. In order to prevent splashing when the machine is worked on uneven ground, two cross partitions are placed in the trough, as shown by the dividing lines. C is the backstop, 4 feet high by 16 feet long, braced by the timber called F. This backstop is a frame of boards set to lean backwards from the trough and covered with some smooth material. The covering should be of oilcloth, or similar substance, so that the

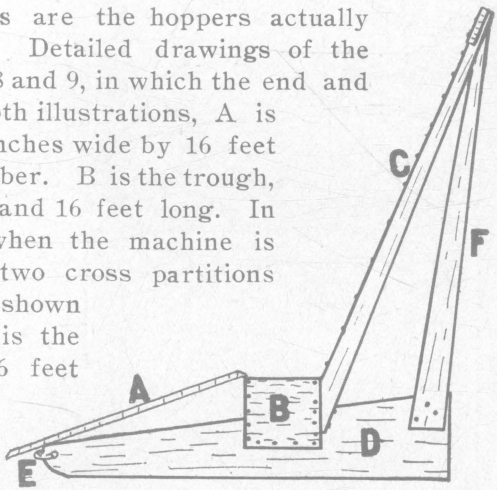

Fig. 8. Drawing showing end view of hopper dozer.

hoppers will not be able to cling to it. D is the runner, about 4 feet long, with the hitch for the horses at E. The best results are obtained when the horses are hitched about 6 feet out from the machine, and are made to travel at a moderately fast walk.

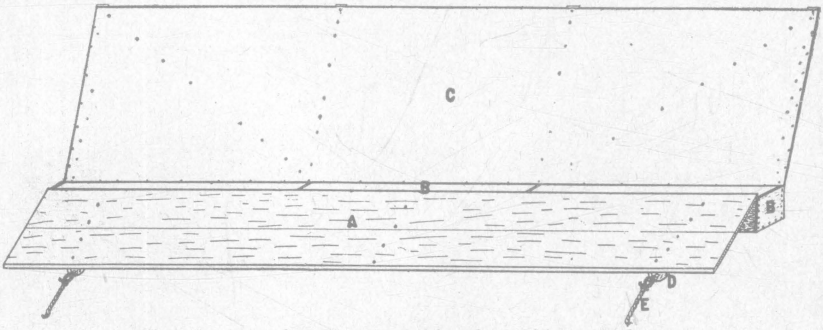

Fig. 9. Drawing showing side view of hopper dozer.

The machine just described was built by 3 men and a boy working for an hour and a half. It was taken to the field and operated for six hours with the result that a barrel and a half of hoppers were collected, as illustrated in Fig. 10. The following day, the dozer was again used several hours with similar results, but the third day it began raining and the work was interrupted for several days. During this interval of inactivity, most of the hoppers left the hay field and became so scattered that the work was not resumed. Unquestionably, however, the results obtained were worth the effort, and the benefit would have been even greater if the weather had not interfered just when it did.

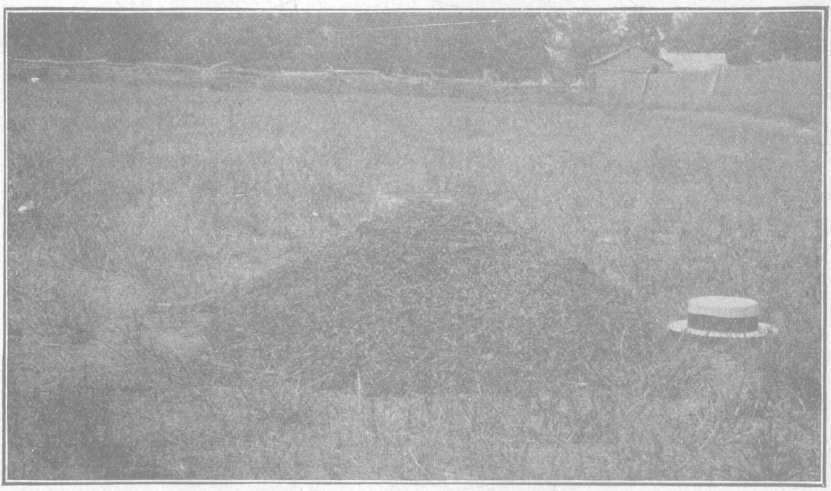

Fig. 10. A barrel and a half of grasshoppers captured by the hopper dozer, working six hours.

Work was commenced on the side of the field bordering the oats and the instrument drawn back and forth from one end of the field to the other. At the end of every round the hoppers were taken from the trough by means of a home-made tin scoop, which was found to work more satisfactorily if it was perforated.

Occasionally, it was found to be necessary to replenish the supply of water and oil in the trough, since there was considerable shrinkage both by slopping over the edges of the trough and by the liquid adhering to the hoppers as they were removed.

The barrel and a half of hoppers did not represent all that were destroyed the first day, since fully one-third as many more crawled up over the rough sides of the trough after being covered with the oil, only to fall to the ground and perish. As a trial, the dozer was run one swath in the oats, along the side of the field bordering the clover stubble. The oats were about knee high and, while many hoppers were captured, it was found that the runners of the machine were so low that too much damage was done the crop, so the work was discontinued.

Taken all in all, the hopper dozer was an admirable success when worked under the conditions existing at Upper Sandusky Farmers from adjoining places came in to see it in operation, and were much pleased with the results obtained. The conditions for operating the machine were ideal; there was no crop to bother and the field was level. If the field is hilly, the dozer does not work so satisfactorily and, in such cases, other methods of control must be used.

BAITING WITH POISONS

In the same field where the hopper dozer was tried out, criddle mixture was tested also. This is made by using 100 lbs. of fresh horse manure, 2 lbs. of salt and 1 lb. of Paris green; the materials being thoroughly mixed and enough water added to make a sloppy mass. The mixture was broadcasted at the rate of about 400 pounds per acre. As soon as the material was spread, the hoppers were observed feeding upon it and several days later when an examination was made, dead hoppers were numerous over the area used in the test.

NATURAL ENEMIES

Many hoppers were noticed which had died from a bacterial or fungous trouble, and fully 30 percent of the living insects had within their bodies one or two specimens of the so-called hair worm or cabbage snake.

RECOMMENDATIONS FOR CONTROLLING HOPPERS

Whenever practicable, the use of the hopper dozer is a very effective and cheap method of destroying grasshoppers. Uneven or stony ground, or certain crop conditions, sometimes prohibit the use of this instrument, and in such cases baiting with poisons is suggested. Criddle mixture, prepared according to directions already given, is one of the cheapest and at the same time one of the most attractive baits that can be used. It is especially recommended for use in gardens, young orchards, etc.